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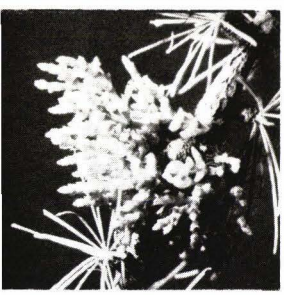

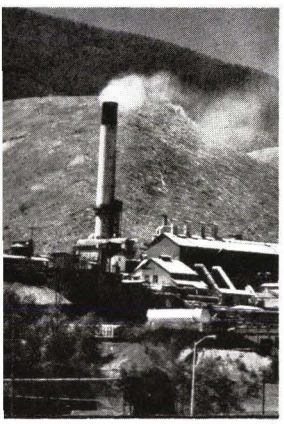

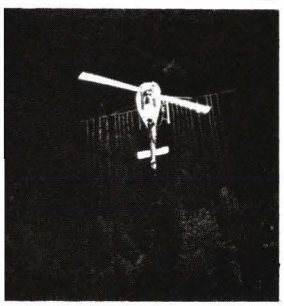

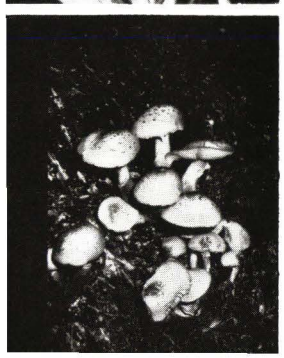

FOREST INSECT & DISEASE MANAGEMENT

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POTENTIAL FOR DEFOLIATION BY WESTERN SPRUCE BUDWORM IN NORTHERN IDAHO AND MONTANA -- 1977

by
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ABSTRACT

Epidemic populations of the western spruce budworm persist in the Northern Region. Aerial surveys made in August 1976 showed a decline in the acreage of aerially visible defoliation. In northern Idaho, the defoliated area dropped from 831,487 acres in 1975 to 655,711 acres in 1976, down 21 percent. Surveys in Montana found a net decrease in defoliation of 11 percent, down from 2,797,986 in 1975 to 2,496,274 in 1976.

Egg mass surveys made in September and October 1976 indicate that defoliation will be light on the Clearwater and Nezperce National Forests and moderate on the Idaho Panhandle National Forests, Idaho, in 1977. Defoliation in Montana during 1977 is expected to be light on the Flathead, moderate on the Kootenai, and heavy on the Beaverhead, Bitterroot, Deerlodge, Gallatin, Helena, Lewis and Clark, and Lolo National Forests and the Flathead Indian Reservation.

INTRODUCTION

Western spruce budworm, *Choristoneura occidentalis* Freeman, outbreaks have been reported annually since 1922 in the Northern Region. Damage was first detected near Kalispell Bay on Priest Lake in northern Idaho (Johnson and Denton, 1975). Since the mid-1960's, infestations have fluctuated in size, but persisted in northern Idaho and western and eastern Montana. For example, this area of aerially visible defoliation decreased from 3,741,445 acres in 1975 to 3,266,557 acres in 1976 in the Region (Table 1), but the intensity of defoliation is predicted to increase on some National Forests in 1977. To illustrate the complexity and duration of these outbreaks, a brief history of budworm infestation on each National Forest is discussed in the text.

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ROCKY MOUNTAIN STATION

Egg mass surveys to predict potential defoliation the following year were made in 1974 and 1975 in Montana. During 1976, these surveys were made on nine National Forests in Montana, the Flathead Indian Reservation in Montana, and three National Forests in northern Idaho. This report predicts defoliation in 1977 for areas surveyed.

TECHNICAL INFORMATION

Hosts: In Montana, the preferred food source is Douglas-fir, *Pseudotsuga menziesii* var. *glauca* (Beissn.). In northern Idaho, grand fir, *Abies grandis* (Dougl.) Lindl., is preferred. In both areas, subalpine fir, *Abies lasiocarpa* (Hook.) Nutt., is the second preferred host. Heavy defoliation can also occur on Engelmann spruce, *Picea engelmannii* Parry; western larch, *Larix occidentalis* Nutt.; and occasionally, on western hemlock, *Tsuga heterophylla* (Raf.) Sarg.; and mountain hemlock, *T. mertensiana* (Bong.) Carr.

Damage: Budworm larvae can eat both old and new foliage. Buds and new foliage are preferred and are consumed first but heavy populations may be forced to feed on older needles. After several consecutive years of heavy defoliation, understory trees are usually killed and upper crowns of more dominant trees begin to die. Codominant and dominant trees can be killed after 5-7 years of heavy defoliation. Trees surviving repeated defoliation exhibit reduced radial growth and may be predisposed to attack by bark beetles or diseases. Observations show grand and subalpine fir in northern Idaho and subalpine fir in Montana are damaged more severely than Douglas-fir growing in the same stand. Topkilled true firs can be found growing next to Douglas-firs that have had only their current foliage consumed.

Dewey (1972) found that in areas where Douglas-fir was heavily defoliated, nearly 100 percent of the cones were destroyed. Topkilling of grand and subalpine fir prevent cone production.

Bousfield, et al. (1973) reported that after 5 years of heavy defoliation, 13.8 percent of a Douglas-fir stand in western Montana had been topkilled. Net growth loss was estimated at 19.6 board feet per acre.

SURVEY METHODS

Only areas that showed aerially visible defoliation in 1976 were sampled for egg masses. Plots were scattered more or less uniformly over National Forest areas where roads provided access. Infested areas were divided into geographical units and average egg mass density was determined for each unit from the plots. A plot consisted of three sample trees from which two 30-inch branches were cut from midcrown on opposite sides of each tree. In Montana, Douglas-fir from 30 to 50 feet in height were sampled with extendable pole pruners. In northern Idaho, codominant grand fir trees, often over 100 feet tall, were sampled by either felling

or climbing. Both branches from each sample tree were put in a labeled paper bag, then the three bags per plot stapled together. Samples were transported to Missoula and refrigerated until examined.

In the laboratory, square inches of foliage on each branch were determined by cutting it into twigs and spreading them out on a grid. All needles containing budworm egg masses were removed. Old and new (1976) egg masses were separated microscopically and counted by a trained observer. The number of new egg masses per thousand square inches of foliage was used to predict the expected level of defoliation in each plot in 1977. The following standards[1/] were used to estimate defoliation:

Average No. egg masses per 1,000 sq.in. foliage in plot	Predicted defoliation (percent)	Damage category
0	0	None
1-3	1-25	Light
4-10	26-40	Moderate
11-40	41-55	Heavy
7 40	56-100	Very heavy

RESULTS AND DISCUSSION

Table 1 shows number of acres of aerially visible defoliation over the entire Northern Region which includes Yellowstone National Park, Wyoming. Overall, there was a net decrease in area of visible defoliation in 1976. The number of acres decreased by 21 percent in northern Idaho from 831,487 in 1975 to 655,711 in 1976, or by 175,776. In Montana, visible defoliation decreased by 11 percent from 2,797,986 acres in 1975 to 2,496,274 in 1976, or by 301,712. Areas of aerially visible defoliation in 1976 are shown on maps of Forests surveyed for egg masses in Figures 1-14, and sample units are also outlined.

1/ The decision to use these prediction standards in 1976 surveys was made at the Western Spruce Budworm Egg Mass Sampling Task Force Meeting in Davis, California, July 22-23, 1976.

Table 1. Acres of aerially visible[1/] western spruce budworm defoliation in the Northern Region from 1975 to 1976

Unit[2/]	Acres of visible defoliation		Increase or decrease in size of infestation
	1975	1976	Acres
Idaho			
Clearwater National Forest	634,830	358,070	-276,760
Idaho Panhandle National Forest	189,617	190,591	+ 974
Nezperce National Forest	7,040[3/]	107,050	+100,010
Subtotal	831,487	655,711	-175,776
Montana			
Beaverhead National Forest	240,990	250,427	+ 9,437
Bitterroot National Forest[4/]	402,504	413,641	+ 11,137
Custer National Forest	000,000	5,155	+ 5,155
Deerlodge National Forest	271,629	223,666	- 47,963
Flathead Indian Reservation	105,705	68,156	- 37,549
Flathead National Forest	111,219	99,801	- 11,418
Gallatin National Forest	337,929	286,325	- 51,604
Helena National Forest	473,937	313,161	-160,776
Kootenai National Forest	3,606	9,685	+ 6,079
Lewis and Clark National Forest	7,367	5,927	- 1,440
Lolo National Forest	843,100	820,330	- 22,770
Subtotal	2,797,986	2,496,274	-301,712
Wyoming			
Yellowstone National Park	111,972	114,572	+ 2,600
Grand total	3,741,445	3,266,557	-474,888

1/ Aerially visible defoliation occurs when 25 percent or more of the current foliage is consumed.

2/ Infested acreage on National Forest maps includes all Federal, State, and private lands.

3/ Entire Nezperce National Forest was not surveyed for budworm defoliation in 1975.

4/ Some of southwest portion of the Bitterroot NF is in northern Idaho.

NORTHERN IDAHO PREDICTIONS

Clearwater National Forest Area

This outbreak started in 1966. Peak visible defoliation occurred in 1975 at 634,830 acres and decreased 44 percent to 358,070 acres in 1976 (Table 1). This seems to indicate the infestation trend is decreasing. Light defoliation is predicted for the Pierce, Kelly Creek, and Lochsa sampling units in 1977 (Table 2) (Fig. 1). In all, 37 plots were sampled in these three units. Egg mass densities on individual plots predict light to moderate defoliation with the exception of Pierce Forage Camp on the Pierce Unit where heavy defoliation is expected in 1977.

Idaho Panhandle National Forests Area

Visible defoliation was first detected in 1969 on the Red Ives Ranger District. It has increased every year and in 1976, all but several hundred of 190,591 acres were reported in the upper St. Joe River headwaters which are mainly on the Red Ives District (Fig. 2). The other spot of defoliation on this Forest is on the Wallace Ranger District and was not sampled for egg masses.

Moderate defoliation is predicted for 1977 in the St. Joe Unit (Table 2). Heavier defoliation is likely along the outer edges of the infestation and in the higher stands of subalpine fir and mountain hemlock.

Observations over the past several years indicate the infestation has been slowly spreading down the St. Joe River towards Avery and west of Red Ives wherever host type is available. Branch dieback and topkill are heavy and some tree mortality is occurring in grand fir stands within Quartz, Bruin, Gold, and Bluff Creeks where defoliation has been heavy for about 5 years. Damaged grand fir will not produce enough new foliage to support very heavy budworm populations in the next few years. Populations usually decrease when old foliage becomes the main food source.

Nezperce National Forest Area

This outbreak started in 1963 on the east end of the Forest. It spread west until the entire host type was infested, and peaked in 1972 when aerially visible defoliation spread over 1,342,000 acres. Hardly any defoliation was visible in 1975 and populations then were considered endemic. There are 14 small areas of defoliation scattered over this Forest which totaled 107,050 acres in 1976 (Table 1). Most of the infestation occurs on the Slate Creek Unit spreading south of Grangeville to the Salmon River. This was the only area accessible for sampling (Fig. 3). Defoliation is predicted to be light in this unit in 1977 (Table 2).

The budworm may be starting another cycle on the Nezperce. A chronic infested area was detected in Bargamin Creek in 1976 which appeared to be the epicenter of the past two outbreaks. If acres of visible defoliation increase significantly in 1977, this may indicate the start of another outbreak.

MONTANA PREDICTIONS

Beaverhead National Forest Area

This is a fairly recent outbreak which started in 1971 in the Tobacco Root Mountains. Acres of visible defoliation have been increasing each year and went from 240,970 acres in 1975 to 250,427 in 1976--a 4 percent increase (Table 1). Most of the increase was on Bureau of Land Management (BLM) lands in the Dillon District (Figs. 4 and 5).

Heavy defoliation is predicted for some areas in the Pioneer Mountains Unit in 1977 (Table 2). The infestation may spread in this unit. Although defoliation was not visible from the air in Trapper Creek, Table 2 shows heavy defoliation will occur. This may be the case in some other drainages of the Pioneers.

Moderate defoliation is predicted for 1977 in the Tobacco Root Mountains Unit where all of the host type is presently infested (Table 2) (Fig. 4).

Heavy defoliation is predicted in the Ruby Unit in 1977 (Table 2). This unit contains most of the BLM land mentioned, and the infestation trend seems to be upward; especially in the Ruby Mountains. Additional acreage may be infested along the Ruby River due to heavy budworm populations.

Heavy defoliation is predicted in the Madison Unit in 1977 (Table 2). Some spread may occur along the east side of the Madison River, but damage should be lighter around Wade and Cliff Lakes.

Bitterroot National Forest Area

The budworm has been a chronic defoliator on the Bitterroot since 1951. Peak aerially visible defoliation occurred in 1965 when 466,400 acres were mapped. The size of the infestation has fluctuated since then and started to increase again in 1975. Visible defoliation was evident on 413,641 acres in 1976 (Table 1).

Heavy defoliation is predicted in the Bitterroot West Unit in 1977 but should be somewhat lighter in the West Fork drainage. Moderate defoliation is predicted in the Bitterroot East Unit in 1977 (Table 2) (Fig. 6).

After all these years of infestation, topkill and mortality are relatively light in Douglas-fir stands over the Forest. Subalpine fir along drainage bottoms has been damaged the most.

Deerlodge National Forest Area

Infestations have been active every year since 1949. The highest number of acres of visible defoliation was 490,470 in 1955. In 1967, only 430 acres were defoliated, but infested acreage has increased steadily since then. However, there was an 18 percent decrease in visible defoliation from 271,629 acres in 1975 to 223,666 acres in 1976 (Table 1).

Heavy defoliation is predicted in the Whitehall and Boulder Units in 1977 (Table 2). Prevalent topkill is occurring in Douglas-fir stands in areas that have been heavily defoliated in the 1970's.

Moderate defoliation is predicted in the Flint Creek Unit in 1977 (Table 2), (Fig. 7). Infested areas in this unit are from 1 to 2 years old and past observations show that new infestations are likely to spread.

Flathead Indian Reservation

The present outbreak started about 1968 and increased until there were 195,500 acres of visible defoliation in 1972. Visible defoliation decreased steadily since then to 68,156 acres in 1976 (Table 1). However, defoliation is predicted to be heavy in 1977 in the remaining infested areas on the Reservation (Fig. 8), (Table 2).

Flathead National Forest Area

Aerially visible defoliation was detected in 1967. Infested acreage fluctuated, but peaked out at 188,000 acres in 1972. Infestations on National Forest lands have gradually decreased since 1973, while those on State and private lands have remained static. Visible defoliation decreased to 99,801 acres in 1976 (Table 1) (Fig. 9). Based on egg mass samples, light defoliation is predicted for 1977 on this Forest.

Gallatin National Forest Area

Budworm epidemics occurred on this Forest during the 1950's and 1960's. The latest one started in 1971. Visible defoliation increased to 337,929 acres in 1975, then decreased 15 percent to 286,325 acres in 1976 (Table 1).

Heavy defoliation is predicted for 1977 in the Bridger Mountain, Gallatin Canyon, and Yellowstone Valley Units (Table 2), (Fig. 10). Most of the high egg mass densities were found in the Bridger Mountain Unit which indicates additional forested lands will become infested

during 1977. The majority of the Douglas-fir type in the Gallatin Canyon Unit is infested. Little spread is anticipated in 1977. Some topkill is expected in this unit next year as 3 years of heavy defoliation have occurred.

Based on history, and the high number of egg masses in the Unit, additional acres may be infested in the north end of the Yellowstone Valley toward Livingston.

Helena National Forest Area

The budworm has been chronic on this Forest longer than any other in Montana. On the Townsend Ranger District, for example, infestations have been reported every year since 1925 (Johnson and Denton, 1975). Aerially visible defoliation was greatest in 1956 when 900,430 acres were mapped. Visible defoliation fluctuated constantly over the years and reached a low of 32,000 acres in 1970, but increased to 473,937 acres in 1975. However, there was a 34 percent decrease to 313,161 acres in 1976 (Table 1).

The entire infested area was divided into four sampling units (Fig. 11). Heavy defoliation is predicted in all units in 1977 (Table 2). In the Helena West Unit, the infestation is expected to spread on the Lincoln Ranger District. In the South of Helena Unit, the infestation may spread along the east-facing slopes west of Canyon Ferry Lake. The amount of visible defoliation may decrease in some drainages within the Canyon Ferry District and Townsend District East Units because these are older infestations where the food source has been depleted. However, topkill is now becoming apparent in these units which indicates stands are becoming susceptible to increased damage.

Kootenai National Forest Area

Aerially visible defoliation has never before been recorded on this Forest. This infestation started in the Vermillion River drainage (Fig. 14) during 1975 and visible defoliation increased to 9,685 acres in 1976 (Table 1). Moderate defoliation is predicted for this area in 1977 (Table 2).

Lewis and Clark National Forest Area

There were epidemics on this Forest in the 1950's and 1960's, but aerially visible defoliation was last mapped during 1969. Another outbreak started in 1973 and visible defoliation increased to 18,534 acres in 1974, but decreased to 5,927 acres by 1976 (Table 1). The 1976 infestation is in new areas (Fig. 12) and egg mass sample plots were taken only in the Castle Mountains southeast of White Sulphur Springs.

Heavy defoliation is predicted in this unit in 1977 (Table 2) and additional acreage will probably become infested.

Lolo National Forest Area

Outbreaks have occurred on some portion of this Forest every year since 1951. During the 1950's, acres of aerially visible defoliation stayed around 10,000. By the 1960's, visible defoliation was in the hundred thousands, and in 1969, 1,554,560 acres of visible defoliation were recorded. This decreased steadily to 820,330 acres in 1976 (Table 1).

Heavy defoliation is predicted in 1977 in the Lolo East (Fig. 13), Clark Fork South, Clark Forth North, and St. Regis Units (Fig. 14), (Table 2).

Infestation spread will probably occur along the Rock Creek drainage and in the Lolo East Unit. Most of the host type is already infested in the other three units and many subalpine fir are being topkilled.

RECOMMENDATIONS

Several years of moderate to heavy defoliation by western spruce budworm can cause topkill and a decrease in seed and cone production. Land managers should consider budworm management alternatives in high value stands where moderate or heavy defoliation is predicted for 1977.

Management:

A. Silvicultural

1. Short Range

a. Priority ranking for sanitation-salvage based on stand examinations.

b. Prepare treatment prescription.

c. Regenerate--artificially and naturally for broad genetic and ecological base.

d. Harvest mortality.

e. Harvest severely damaged trees.

2. Long Range

a. Achieve as diverse a mosaic of vegetation as is reasonable within overall land use objectives.

b. Direct management toward intolerant species.

c. Direct management toward single-storied stands.

d. Even-aged management.

e. Select apparently resistant trees; make test plantations.

B. Chemical - Malathion (13 ounces per acre) and Sevin 4-Oil (1 pound per acre) are registered for treating western spruce budworm epidemics.

C. No Treatment

1. Continue assessment and accounting for growth loss and mortality.

2. Continue assessment of beneficial effects on age class distribution, other species, and resources.

There are numerous parasites and predators of the budworm; however, by themselves they do not seem to be able to terminate an outbreak. It probably takes a complex of factors such as parasitism, predation, starvation, disease, and weather to end an epidemic.

ACKNOWLEDGEMENT

Information for this report was obtained by the aid of entomologists, technicians, and seasonal help in Forest Environmental Protection. Further contributions were made by personnel on the Clearwater, Idaho Panhandle, Nezperce, Beaverhead, Deerlodge, and Helena National Forests.

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Table 2.--Potential defoliation in 1977 on western spruce budworm plots in northern Idaho and Montana

Plot area	Plot location	New egg masses per 1000 sq. in. foliage	Predicted defoliation in 1977	
			Percent	Category
	CLEARWATER NF, Idaho			
	Pierce Unit			
Brown's Rock	T. 39 N., R. 6 E., sec. 21	0.0	0	None
Dull Axe	T. 39 N., R. 6 E., sec. 30	0.3	1-25	Light
Brush Creek	T. 39 N., R. 6 E., sec. 28	0.7	1-25	Light
Elk Mtn. Road	T. 38 N., R. 7 E., sec. 18	9.1	26-40	Moderate
Ridge Road	T. 38 N., R. 6 E., sec. 13	3.2	1-25	Light
Larch Butte	T. 37 N., R. 7 E., sec. 12	9.2	1-25	Light
Sylvan Saddle	T. 37 N., R. 7 E., sec. 22	2.1	1-25	Light
Sylvan Road	T. 37 N., R. 6 E., sec. 25	1.9	1-25	Light
Pierce Ridge	T. 37 N., R. 8 E., sec. 31	3.1	1-25	Light
Pierce Forage Camp	T. 37 N., R. 8 E., sec. 32	12.8	41-55	Heavy
French Saddle	T. 36 N., R. 6 E., sec. 2	7.6	26-40	Moderate
Rescue Creek	T. 36 N., R. 6 E., sec. 11	4.5	26-40	Moderate
Savage Camp	T. 36 N., R. 7 E., sec. 12	4.2	26-40	Moderate
Willow Ridge	T. 36 N., R. 9 E., sec. 30	0.3	1-25	Light
Little Weitas Butte	T. 36 N., R. 8 E., sec. 28	0.0	0	None
Windy Saddle	T. 35 N., R. 7 E., sec. 14	0.0	0	None
Canyon Meadow	T. 34 N., R. 7 E., sec. 3	1.0	1-25	Light
Moosehorn	T. 34 N., R. 7 E., sec. 8	0.1	1-25	Light
Jungle Point	T. 33 N., R. 6 E., sec. 15	0.4	1-25	Light
Average		3.2	1-25	Light
	Kelly Creek Unit			
Cayuse Creek	T. 39 N., R. 11 E., sec. 34	3.8	26-40	Moderate
East Saddle	T. 39 N., R. 11 E., sec. 28	5.4	26-40	Moderate
Moose City	T. 40 N., R. 11 E., sec. 29	2.9	1-25	Light
Oster Ridge	T. 40 N., R. 11 E., sec. 9	4.1	26-40	Moderate
Cedars	T. 41 N., R. 11 E., sec. 33	1.9	1-25	Light
Long Creek	T. 41 N., R. 11 E., sec. 22	2.1	1-25	Light
Birch Hill	T. 41 N., R. 11 E., sec. 20	2.2	1-25	Light
Average		3.2	1-25	Light
	Lochsa Unit			
Shotgun	T. 38 N., R. 15 E., sec. 32	1.1	1-25	Light
Crooked Creek	T. 37 N., R. 15 E., sec. 7	0.0	0	None
Bear Camp	T. 37 N., R. 14 E., sec. 10	5.6	26-40	Moderate
Papoose Creek	T. 37 N., R. 14 E., sec. 18	1.1	1-25	Light
Elk Summit Road	T. 37 N., R. 14 E., sec. 35	0.7	1-25	Light
Papoose Creek	T. 37 N., R. 13 E., sec. 24	0.0	0	None

Table 2 (Continued)

Plot area	Plot location	New egg masses per 1000 sq. in. foliage	Predicted defoliation in 1977	
			Percent	Category
	Lochsa Unit (Cont.)			
Squaw Saddle	T. 37 N., R. 13 E., sec. 20	0.9	1-25	Light
Squaw Creek	T. 37 N., R. 13 E., Sec. 18	7.6	26-40	Moderate
Deep Saddle	T. 37 N., R. 12 E., sec. 27	7.7	26-40	Moderate
Indian Graves	T. 36 N., R. 11 E., sec. 8	5.0	26-40	Moderate
Colt Creek	T. 36 N., R. 15 E., sec. 26	0.8	1-25	Light
Average		2.8	1-25	Light
	IDAHO PANHANDLE NF			
	St. Joe Unit			
Turner Creek	T. 45 N., R. 6 E., sec. 12	15.3	41-55	Heavy
Tourist Creek	T. 45 N., R. 6 E., sec. 14	4.3	26-40	Moderate
Bird Creek	T. 45 N., R. 7 E., sec. 7	8.8	26-40	Moderate
Eagle Creek	T. 45 N., R. 7 E., sec. 14	12.5	41-55	Heavy
Tumbledown Creek	T. 45 N., R. 8 E., sec. 33	6.3	26-40	Moderate
Quartz Creek	T. 45 N., R. 8 E., sec. 16	10.8	41-55	Heavy
Quartz Ridge	T. 45 N., R. 8 E., sec. 31	4.4	26-40	Moderate
Entente Creek	T. 45 N., R. 8 E., sec. 8	6.4	26-40	Moderate
Float Creek	T. 45 N., R. 9 E., sec. 19	15.4	41-55	Heavy
Pretty Creek	T. 45 N., R. 9 E., sec. 31	9.7	26-40	Moderate
Fuzzy Creek	T. 44 N., R. 7 E., sec. 1	1.4	1-25	Light
W. Fk. Bluff Creek	T. 44 N., R. 7 E., sec. 23	2.5	1-25	Light
E. Fk. Bluff Creek	T. 44 N., R. 7 E., sec. 24	0.8	1-25	Light
Wahoo Creek	T. 44 N., R. 9 E., sec. 32	3.9	26-40	Moderate
Gold Ridge	T. 44 N., R. 9 E., sec. 9	23.1	41-55	Heavy
Average		8.4	26-40	Moderate
	NEZPERCE NF, Idaho			
	Slate Creek Unit			
Dump Creek	T. 29 N., R. 3 E., sec. 24	0	0	None
Cayuse Junction Rd.	T. 29 N., R. 3 E., sec. 34	1.7	1-25	Light
Grouse Creek	T. 28 N., R. 4 E., sec. 7	3.7	26-40	Moderate
Camp Creek	T. 27 N., R. 3 E., sec. 13	1.8	1-25	Light
Rocky Bluff Camp	T. 27 N., R. 4 E., sec. 31	3.6	26-40	Moderate
Nut Basin Road	T. 26 N., R. 2 E., sec. 14	4.2	26-40	Moderate
Florence Road	T. 26 N., R. 3 E., sec. 12	1.9	1-25	Light
Allison Creek	T. 25 N., R. 3 E., sec. 18	2.3	1-25	Light
Seaburg	T. 25 N., R. 3 E., sec. 25	0.5	1-25	Light
Average		2.2	1-25	Light

Table 2 (Continued)

Plot area	Plot location	New egg masses per 1000 sq. in. foliage	Predicted defoliation in 1977	
			Percent	Category
	BEAVERHEAD NF, Montana			
	Pioneer Mountains Unit			
Quartz Hill Gulch	T. 1 S., R. 10 W., Sec. 17	2.7	1-25	Light
Trapper Creek	T. 2 S., R. 10 W., sec. 20	13.9	41-55	Heavy
Birch Creek	T. 5 S., R. 10 W., sec. 9	18.4	41-55	Heavy
Average		11.7	41-55	Heavy
	Tobacco Root Mountains Unit			
Strawberry Ridge	T. 2 S., R. 3 W., sec. 15	8.5	26-40	Moderate
N. Willow Creek	T. 2 S., R. 3 W., sec. 24	13.9	41-55	Heavy
S. Willow Creek	T. 2 S., R. 2 W., sec. 33	25.1	41-55	Heavy
Potosi	T. 3 S., R. 2 W., sec. 18	8.4	26-40	Moderate
N. Meadow Creek	T. 3 S., R. 2 W., sec. 29	0.8	1-25	Light
Nobel Fork	T. 3 S., R. 4 W., sec. 33	3.8	26-40	Moderate
Mill Creek	T. 4 S., R. 4 W., sec. 13	0.7	1-25	Light
Currant Creek	T. 4 S., R. 4 W., sec. 25	0.3	1-25	Light
S. Meadow Creek	T. 4 S., R. 2 W., sec. 33	0.0	0	None
Fletcher Creek	T. 5 S., R. 2 W., sec. 10	5.3	26-40	Moderate
California Creek	T. 5 S., R. 3 W., sec. 8	15.5	41-55	Heavy
Granite Creek	T. 5 S., R. 3 W., sec. 36	0.7	1-25	Light
Average		6.9	26-40	Moderate
	Ruby Unit			
Brown Gulch	T. 7 S., R. 3 W., sec. 4	14.8	41-55	Heavy
Alder Gulch	T. 7 S., R. 3 W., sec. 12	35.6	41-55	Heavy
Hungry Hollow	T. 7 S., R. 3 W., sec. 10	1.4	1-25	Light
Barton Gulch	T. 7 S., R. 4 W., sec. 14	41.7	56-100	V. Heavy
Hoffman Gulch	T. 8 S., R. 7 W., sec. 21	0.0	0	None
Upper Timber	T. 8 S., R. 3 W., sec. 26	10.8	41-55	Heavy
Lower Timber	T. 9 S., R. 3 W., sec. 9	4.4	26-40	Moderate
Warm Springs Creek	T. 9 S., R. 3 W., sec. 23	12.4	41-55	Heavy
Short Creek	T. 10 S., R. 3 W., sec. 11	2.8	1-25	Light
Average		13.8	41-55	Heavy
	Madison Unit			
Cedar Creek	T. 6 S., R. 1 E., sec. 22	19.7	41-55	Heavy
Gravelly Range Rd.	T. 8 S., R. 2 W., sec. 11	3.7	26-40	Moderate
Bear Creek	T. 8 S., R. 1 E., sec. 12	1.1	1-25	Light
Indian Creek	T. 8 S., R. 1 E., sec. 26	34.2	41-55	Heavy
Johnny Ridge	T. 9 S., R. 1 W., sec. 18	4.5	26-40	Moderate
Wall Creek R.S.	T. 9 S., R. 1 W., sec. 34	10.0	26-40	Moderate

Table 2 (Continued)

Plot area	Plot location	New egg masses per 1000 sq. in. foliage	Predicted defoliation in 1977	
			Percent	Category
	Madison Unit (Cont.)			
Wall Creek R.S.	T. 9 S., R. 1 W., sec. 34	7.4	26-40	Moderate
Papoose Creek	T. 11 S., R. 1 E., sec. 1	13.4	41-55	Heavy
W. Fk. Campground	T. 11 S., R. 1 E., sec. 15	37.8	41-55	Heavy
Wade Lake	T. 12 S., R. 1 E., sec. 11	3.2	1-25	Light
Average		13.5	41-55	Heavy
	BITTERROOT NF, Montana			
	Bitterroot West Unit			
Sweeney Creek	T. 10 N., R. 20 W., sec. 17	33.9	41-55	Heavy
Bass Creek	T. 10 N., R. 20 W., sec. 31	32.6	41-55	Heavy
St. Mary Road	T. 9 N., R. 21 W., sec. 36	36.1	41-55	Heavy
Gash Creek	T. 7 N., R. 21 W., sec. 5	36.9	41-55	Heavy
Cow Creek	T. 7 N., R. 21 W., sec. 33	23.7	41-55	Heavy
Roaring Lion Creek	T. 5 N., R. 21 W., sec. 16	26.3	41-55	Heavy
Hayes Creek	T. 4 N., R. 21 W., sec. 5	15.8	41-55	Heavy
Little W. Fk. Road	T. 1 N., R. 22 W., sec. 33	5.7	26-40	Moderate
Nez Perce Pass	T. 1 S., R. 23 W., sec. 19	0	0	None
Overwhich Creek	T. 2 S., R. 22 W., sec. 14	6.2	26-40	Moderate
Woods Creek	T. 3 S., R. 22 W., sec. 20	4.1	26-40	Moderate
Average		20.1	41-55	Heavy
	Bitterroot East Unit			
Threemile Creek	T. 10 N., R. 18 W., sec. 21	0.9	1-25	Light
Willow Creek	T. 6 N., R. 19 W., sec. 2	3.3	1-25	Light
Skalkaho Creek	T. 5 N., R. 19 W., sec. 28	10.2	26-40	Moderate
Sleeping Child Cr.	T. 4 N., R. 20 W., sec. 2	16.8	41-55	Heavy
Rye Creek	T. 2 N., R. 19 W., sec. 4	18.5	41-55	Heavy
Lyman Creek	T. 2 N., R. 19 W., sec. 13	4.6	26-40	Moderate
Tepee Creek	T. 2 N., R. 17 W., sec. 18	13.2	41-55	Heavy
Springer Creek	T. 2 N., R. 18 W., sec. 25	8.7	26-40	Moderate
Mink Creek	T. 1 N., R. 18 W., sec. 6	15.9	41-55	Heavy
Average		10.2	26-40	Moderate

Table 2 (Continued)

Plot area	Plot location	New egg masses per 1000 sq. in. foliage	Predicted defoliation in 1977	
			Percent	Category
	DEERLODGE NF, Montana			
	Whitehall Unit			
Bear Gulch	T. 3 S., R. 5 W., sec. 2	1.9	1-25	Light
Mill Creek	T. 2 S., R. 4 W., sec. 5	10.5	26-40	Moderate
South Boulder	T. 2 S., R. 3 W., sec. 7	5.8	26-40	Moderate
South Boulder	T. 1 S., R. 3 W., sec. 32	9.2	26-40	Moderate
Bone Basin	T. 1 S., R. 4 W., sec. 10	3.4	1-25	Light
Two Heart Creek	T. 1 N., R. 6 W., sec. 33	25.6	41-55	Heavy
S. Fk. Fish Creek	T. 1 N., R. 6 W., sec. 30	42.4	56-100	V. Heavy
Fall Mountain	T. 1 N., R. 6 W., sec. 9	26.0	41-55	Heavy
Thompson Park	T. 1 N., R. 7 W., sec. 3	0.0	0	None
Bald Mountain	T. 2 N., R. 6 W., sec. 33	0.0	0	None
Divide Creek	T. 2 N., R. 9 W., sec. 32	14.2	41-55	Heavy
Spire Rock Flat	T. 2 N., R. 5 W., sec. 5	20.4	41-55	Heavy
Halfway Creek	T. 3 N., R. 6 W., sec. 26	17.3	41-55	Heavy
Gillispee Ranch	T. 3 N., R. 5 W., sec. 21	27.4	41-55	Heavy
Dunn Canyon	T. 3 N., R. 3 W., sec. 9	1.5	1-25	Light
State Creek	T. 4 N., R. 5 W., sec. 12	15.2	41-55	Heavy
Average		13.8	41-55	Heavy
	Boulder Unit			
Whitetail Creek	T. 5 N., R. 4 W., sec. 28	23.8	41-55	Heavy
Elder Creek	T. 5 N., R. 5 W., sec. 13	18.4	41-55	Heavy
Galena	T. 6 N., R. 5 W., sec. 33	13.5	41-55	Heavy
Elkhorn Creek	T. 6 N., R. 3 W., sec. 33	10.9	41-55	Heavy
E. Fk. Dry Creek	T. 6 N., R. 2 W., sec. 32	12.6	41-55	Heavy
Elkhorn Creek	T. 6 N., R. 3 W., sec. 14	7.0	26-40	Moderate
Boomerang Gulch	T. 6 N., R. 4 W., sec. 18	52.3	56-100	V. Heavy
Spring Gulch	T. 6 N., R. 5 W., sec. 8	20.2	41-55	Heavy
High Ore Creek	T. 6 N., R. 5 W., sec. 2	22.2	41-55	Heavy
Redrock Creek	T. 6 N., R. 6 W., sec. 10	2.9	1-25	Light
E. of Deerlodge	T. 7 N., R. 8 W., sec. 10	31.2	41-55	Heavy
Average		19.5	41-55	Heavy
	Flint Creek Unit			
N. Fk. Rock Creek	T. 6 N., R. 16 W., sec. 21	0.0	0	None
Stoney Creek	T. 7 N., R. 16 W., sec. 29	14.9	41-55	Heavy
Flint Creek	T. 8 N., R. 14 W., sec. 36	9.4	26-40	Moderate
Smart Creek	T. 8 N., R. 13 W., sec. 6	27.4	41-55	Heavy
Tewfel Gulch	T. 10 N., R. 10 W., sec. 8	0.9	1-25	Light
Swamp Creek	T. 11 N., R. 11 W., sec. 27	9.2	26-40	Moderate
Average		10.3	26-40	Moderate

Table 2 (Continued)

Plot area	Plot location	New egg masses per 1000 sq. in. foliage	Predicted defoliation in 1977	
			Percent	Category
	FLATHEAD INDIAN RES., Mont.			
N. Crow Creek	T. 21 N., R. 19 W., sec. 15	0.7	1-25	Light
Camas Creek	T. 20 N., R. 25 W., sec. 25	18.5	41-55	Heavy
Clear Creek	T. 19 N., R. 24 W., sec. 21	12.5	41-55	Heavy
Valley Creek	T. 17 N., R. 21 W., sec. 18	11.5	41-55	Heavy
S. Fk. Valley Cr.	T. 16 N., R. 21 W., sec. 17	17.0	41-55	Heavy
Saddle Mountain	T. 16 N., R. 20 W., sec. 8	7.3	26-40	Moderate
Finley Creek	T. 16 N., R. 20 W., sec. 22	19.0	41-55	Heavy
Charity Peak	T. 15 N., R. 20 W., sec. 11	4.2	26-40	Moderate
Pipeline	T. 15 N., R. 19 W., sec. 7	13.1	41-55	Heavy
Average		11.5	41-55	Heavy
	FLATHEAD NF, Montana			
Emery Hill	T. 31 N., R. 18 W., sec. 31	0.2	1-25	Light
Emery Creek	T. 31 N., R. 18 W., sec. 32	0.0	0	None
Upper Dayton Creek	T. 26 N., R. 21 W., sec. 31	1.9	1-25	Light
Dayton Creek	T. 26 N., R. 21 W., sec. 33	3.2	1-25	Light
Crane Creek	T. 25 N., R. 19 W., sec. 3	2.1	1-25	Light
Fatly Creek	T. 23 N., R. 18 W., sec. 28	0.3	1-25	Light
Kraft Creek	T. 20 N., R. 17 W., sec. 34	0.3	1-25	Light
Beaver Creek	T. 18 N., R. 17 W., sec. 2	0.3	1-25	Light
Average		1.0	1-25	Light
	GALLATIN NF, Montana			
	Bridger Mountain Unit			
Bridger Pass Creek	T. 3 N., R. 5 E., sec. 36	30.5	41-55	Heavy
Johnson Creek	T. 3 N., R. 5 E., sec. 36	14.9	41-55	Heavy
Nixon Creek	T. 2 N., R. 7 E., sec. 26	34.4	41-55	Heavy
Horse Creek	T. 2 N., R. 7 E., sec. 34	30.5	41-55	Heavy
Battle Ridge	T. 1 N., R. 7 E., sec. 4	25.3	41-55	Heavy
Beasley Creek	T. 1 S., R. 6 E., sec. 24	59.9	56-100	V. Heavy
Bridger Creek	T. 1 S., R. 6 E., sec. 34	0.0	0	None
White Creek	T. 1 S., R. 7 E., sec. 3	50.2	56-100	V. Heavy
Pine Creek	T. 1 S., R. 7 E., sec. 7	66.9	56-100	V. Heavy
Stone Creek	T. 1 S., R. 7 E., sec. 10	55.5	56-100	V. Heavy
Jackson Creek	T. 1 S., R. 7 E., sec. 36	57.3	56-100	V. Heavy
Jackson Creek	T. 1 S., R. 8 E., sec. 31	46.8	56-100	V. Heavy

Table 2 (Continued)

Plot area	Plot location	New egg masses per 1000 sq. in. foliage	Predicted defoliation in 1977	
			Percent	Category
	Bridger Mountain Unit (Con.)			
Spring Creek	T. 1 S., R. 8 E., sec. 30	22.6	41-55	Heavy
Trail Creek	T. 2 S., R. 7 E., sec. 34	18.7	41-55	Heavy
Bozeman Pass	T. 2 S., R. 8 E., sec. 19	29.1	41-55	Heavy
Bozeman Pass	T. 2 S., R. 8 E., sec. 20	35.6	41-55	Heavy
Bozeman Pass	T. 2 S., R. 8 E., sec. 20	48.3	56-100	V. Heavy
Average		36.8	41-55	Heavy
	Gallatin Canyon Unit			
Hyalite Creek	T. 3 S., R. 5 E., sec. 25	12.5	41-55	Heavy
Hyalite Creek	T. 3 S., R. 6 E., sec. 30	14.5	41-55	Heavy
Spanish Creek	T. 4 S., R. 3 E., sec. 28	37.1	41-55	Heavy
Spanish Creek	T. 4 S., R. 3 E., sec. 32	31.1	41-55	Heavy
Squaw Creek	T. 4 S., R. 4 E., sec. 28	21.6	41-55	Heavy
Squaw Creek	T. 4 S., R. 4 E., sec. 28	22.5	41-55	Heavy
Squaw Creek	T. 4 S., R. 4 E., sec. 33	17.4	41-55	Heavy
Hell Roaring Cr.Tr.	T. 4 S., R. 4 E., sec. 33	43.6	56-100	V. Heavy
Moose Creek	T. 5 S., R. 4 E., sec. 36	44.9	56-100	V. Heavy
Swan Creek	T. 5 S., R. 4 E., sec. 25	33.2	41-55	Heavy
Swan Creek	T. 5 S., R. 5 E., sec. 30	41.7	56-100	V. Heavy
Greek Creek	T. 5 S., R. 5 E., sec. 19	45.7	56-100	V. Heavy
Big Sky	T. 6 S., R. 4 E., sec. 32	15.9	41-55	Heavy
Dudley Creek	T. 6 S., R. 4 E., sec. 33	18.9	41-55	Heavy
Moose Creek	T. 6 S., R. 5 E., sec. 6	9.3	26-40	Moderate
Moose Creek	T. 6 S., R. 5 E., sec. 5	20.4	41-55	Heavy
Upper Doe Creek	T. 7 S., R. 4 E., sec. 20	8.1	26-40	Moderate
Upper Doe Creek	T. 7 S., R. 4 E., sec. 32	0.7	1-25	Light
Red Cliff	T. 8 S., R. 4 E., sec. 4	44.4	56-100	V. Heavy
Average		25.4	41-55	Heavy
	Yellowstone Valley Unit			
Dry Creek	T. 5 S., R. 7 E., sec. 32	50.8	56-100	V. Heavy
Dry Creek	T. 6 S., R. 7 E., sec. 4	34.1	41-55	Heavy
Big Creek	T. 6 S., R. 6 E., sec. 24	33.9	41-55	Heavy
Big Creek	T. 6 S., R. 7 E., sec. 18	21.1	41-55	Heavy
Big Creek	T. 6 S., R. 7 E., sec. 18	25.2	41-55	Heavy
Yellowstone River	T. 7 S., R. 7 E., sec. 32	52.3	56-100	V. Heavy
Yankee Jim Creek	T. 8 S., R. 7 E., sec. 4	10.5	26-40	Moderate
Yankee Jim Creek	T. 8 S., R. 7 E., sec. 4	16.5	41-55	Heavy
Heron Creek	T. 8 S., R. 7 E., sec. 24	6.3	26-40	Moderate
Cinnabar	T. 8 S., R. 7 E., sec. 26	10.3	26-40	Moderate
Jardine	T. 9 S., R. 9 E., sec. 8	31.7	41-55	Heavy
Average		26.6	41-55	Heavy

Table 2 (Continued)

Plot area	Plot location	New egg masses per 1000 sq. in. foliage	Predicted defoliation in 1977	
			Percent	Category
	HELENA NF, Montana			
	Helena West Unit			
Sandbar Creek	T. 14 N., R. 6 W., sec. 5	2.7	1-25	Light
Flesher Pass	T. 14 N., R. 6 W., sec. 15	8.3	26-40	Moderate
Hogum Creek	T. 14 N., R. 7 W., sec. 17	8.8	26-40	Moderate
Specimen Creek	T. 14 N., R. 6 W., sec. 34	41.9	56-100	V. Heavy
Stemple Creek	T. 13 N., R. 7 W., sec. 12	33.1	41-55	Heavy
Mill Creek	T. 13 N., R. 6 W., sec. 12	14.6	41-55	Heavy
Pikes Gulch	T. 13 N., R. 6 W., sec. 32	33.6	41-55	Heavy
Cellar Gulch	T. 12 N., R. 7 W., sec. 11	9.2	26-40	Moderate
Marysville	T. 12 N., R. 6 W., sec. 35	30.5	41-55	Heavy
Lost Horse Creek	T. 12 N., R. 6 W., sec. 31	36.5	41-55	Heavy
Mullen Pass	T. 10 N., R. 6 W., sec. 2	12.8	41-55	Heavy
Elliston Creek	T. 9 N., R. 7 W., sec. 11	22.5	41-55	Heavy
Slate Creek	T. 9 N., R. 7 W., sec. 25	13.9	41-55	Heavy
Average		20.6	41-55	Heavy
	South of Helena Unit			
Crystal Creek	T. 8 N., R. 2 W., sec. 3	2.2	1-25	Light
Upper Lump Gulch	T. 8 N., R. 4 W., sec. 17	0.6	1-25	Light
Weasel Creek	T. 7 N., R. 1 W., sec. 22	21.9	41-55	Heavy
Bear Creek	T. 7 N., R. 1 W., sec. 32	1.6	1-25	Light
Colconda Creek	T. 7 N., R. 3 W., sec. 17	6.4	26-40	Moderate
Clancy Creek	T. 7 N., R. 4 W., sec. 15	86.2	56-100	V. Heavy
Wicks	T. 7 N., R. 4 W., sec. 21	32.0	41-55	Heavy
Saddler Gulch	T. 6 N., R. 2 W., sec. 36	13.4	41-55	Heavy
Average		20.5	41-55	Heavy
	Canyon Ferry District Unit			
Burnt Gulch	T. 13 N., R. 1 W., sec. 25	2.0	1-25	Light
Pike Gulch	T. 13 N., R. 1 E., sec. 30	18.2	41-55	Heavy
Bowman Gulch	T. 12 N., R. 1 E., sec. 7	1.6	1-25	Light
Bear Trap Gulch	T. 12 N., R. 1 W., sec. 24	8.9	26-40	Moderate
Magpie Creek	T. 12 N., R. 1 E., sec. 35	22.3	41-55	Heavy
Wagner Gulch	T. 12 N., R. 2 E., sec. 36	60.1	56-100	V. Heavy
Dry Range	T. 12 N., R. 3 E., sec. 13	2.4	1-25	Light
Dry Range	T. 12 N., R. 3 E., sec. 24	1.3	1-25	Light
Bar Gulch	T. 11 N., R. 1 E., sec. 17	5.1	26-40	Moderate
Tick Gulch	T. 11 N., R. 2 E., sec. 16	15.4	41-55	Heavy
Spring Gulch	T. 10 N., R. 2 E., sec. 10	0	0	None
Vermont Gulch	T. 10 N., R. 3 E., sec. 6	4.2	26-40	Moderate
Average		11.8	41-55	Heavy

Table 2 (Continued)

Plot area	Plot location	New egg masses per 1000 sq. in. foliage	Predicted defoliation in 1977	
			Percent	Category
	Townsend District E. Unit			
Confederate Gulch	T. 10 N., R. 3 E., sec. 20	2.2	1-25	Light
Duck Creek	T. 8 N., R. 3 E., sec. 4	10.9	41-55	Heavy
Gurnett Creek	T. 8 N., R. 3 E., sec. 16	7.4	26-40	Moderate
Holloway Gulch	T. 7 N., R. 4 E., sec. 5	5.6	26-40	Moderate
W. Fk. Cabin Gulch	T. 7 N., R. 4 E., sec. 9	5.1	26-40	Moderate
Russel Fork	T. 7 N., R. 5 E., sec. 17	14.6	41-55	Heavy
Skid Way	T. 7 N., R. 5 E., sec. 22	10.0	26-40	Moderate
Grassy Mountain	T. 6 N., R. 5 E., sec. 16	23.6	41-55	Heavy
Ridge Road	T. 6 N., R. 4 E., sec. 23	34.7	41-55	Heavy
Dry Creek	T. 6 N., R. 4 E., sec. 29	12.2	41-55	Heavy
Average		12.6	41-55	Heavy
	KOOTENAI NF, Montana			
	Vermillion R. Unit			
Miners Gulch	T. 24 N., R. 30 W., sec. 1	10.9	41-55	Heavy
Sims Creek	T. 24 N., R. 30 W., sec. 2	7.1	26-40	Moderate
Sparrow Gulch	T. 25 N., R. 29 W., sec. 34	13.3	41-55	Heavy
Average		10.4	26-40	Moderate
	LEWIS & CLARK NF, Mont.			
	Castle Mountain Unit			
Checkerboard	T. 9 N., R. 9 E., sec. 17	26.0	41-55	Heavy
Lower Agate Creek	T. 8 N., R. 7 E., sec. 36	47.7	56-100	V. Heavy
Warm Spring Creek	T. 8 N., R. 8 E., sec. 26	11.2	41-55	Heavy
Upper Agate Creek	T. 8 N., R. 8 E., sec. 36	16.4	41-55	Heavy
Lowen	T. 7 N., R. 8 E., sec. 4	9.7	26-40	Moderate
Average		22.2	41-55	Heavy
	LOLO NF, Montana			
	Lolo East Unit			
Brewster Creek	T. 10 N., R. 16 W., sec. 14	6.7	26-40	Moderate
Beavertail Creek	T. 11 N., R. 16 W., sec. 24	27.6	41-55	Heavy
Peuson Creek	T. 14 N., R. 13 W., sec. 2	15.7	41-55	Heavy
Lost Horse Creek	T. 15 N., R. 15 W., sec. 24	2.5	1-25	Light
Average		13.1	41-55	Heavy

Table 2 (Continued)

Plot area	Plot location	New egg masses per 1000 sq. in. foliage	Predicted defoliation in 1977	
			Percent	Category
	Clark Fork South Unit			
Mormon Peak	T. 11 N., R. 20 W., sec. 7	10.9	41-55	Heavy
Marshall Creek	T. 11 N., R. 22 W., sec. 2	14.4	41-55	Heavy
Lolo Hot Springs	T. 12 N., R. 23 W., sec. 36	11.4	41-55	Heavy
Howard Creek	T. 12 N., R. 23 W., sec. 22	10.0	26-40	Moderate
Blue Mountain	T. 12 N., R. 20 W., sec. 7	53.7	56-100	V. Heavy
Surveyor Creek	T. 13 N., R. 25 W., sec. 36	13.5	41-55	Heavy
Martin Point	T. 14 N., R. 23 W., sec. 26	26.9	41-55	Heavy
W. Fk. Fish Creek	T. 14 N., R. 25 W., sec. 26	17.3	41-55	Heavy
Plateau	T. 14 N., R. 23 W., sec. 4	20.2	41-55	Heavy
Albert Creek	T. 14 N., R. 22 W., sec. 13	36.0	41-55	Heavy
Trout Creek	T. 15 N., R. 26 W., sec. 6	20.8	41-55	Heavy
Cedar Creek	T. 15 N., R. 27 W., sec. 4	4.3	26-40	Moderate
Thompson Peak	T. 16 N., R. 26 W., sec. 8	9.8	26-40	Moderate
Average		19.2	41-55	Heavy
	Clark Fork North Unit			
Kennedy Creek	T. 16 N., R. 23 W., sec. 14	12.9	41-55	Heavy
Josephine Creek	T. 16 N., R. 23 W., sec. 5	17.8	41-55	Heavy
Deep Creek	T. 16 N., R. 25 W., sec. 25	21.4	41-55	Heavy
Johnson Creek	T. 17 N., R. 25 W., sec. 29	19.8	41-55	Heavy
Seigle Creek	T. 17 N., R. 25 W., sec. 27	24.3	41-55	Heavy
Upper Nine Mile	T. 17 N., R. 24 W., sec. 17	14.6	41-55	Heavy
Camp Creek	T. 17 N., R. 24 W., sec. 24	30.2	41-55	Heavy
Sloway Gulch	T. 18 N., R. 26 W., sec. 30	15.6	41-55	Heavy
Henry Creek	T. 20 N., R. 25 W., sec. 27	27.9	41-55	Heavy
Average		20.5	41-55	Heavy
	St. Regis Unit			
Little Joe	T. 17 N., R. 28 W., sec. 17	10.9	41-55	Heavy
Ward Creek	T. 18 N., R. 29 W., sec. 22	11.2	41-55	Heavy
Moon Peak	T. 18 N., R. 29 W., sec. 17	20.1	41-55	Heavy
Up Up Mountain	T. 18 N., R. 29 W., sec. 5	18.7	41-55	Heavy
Patricks Knob	T. 19 N., R. 26 W., sec. 27	31.6	41-55	Heavy
Camels Hump	T. 19 N., R. 28 W., sec. 32	60.5	56-100	V. Heavy
Rock Creek	T. 19 N., R. 29 W., sec. 22	40.7	56-100	V. Heavy
Savenac	T. 19 N., R. 30 W., sec. 11	20.1	41-55	Heavy
Average		26.7	41-55	Heavy

CLEARWATER
National Forest

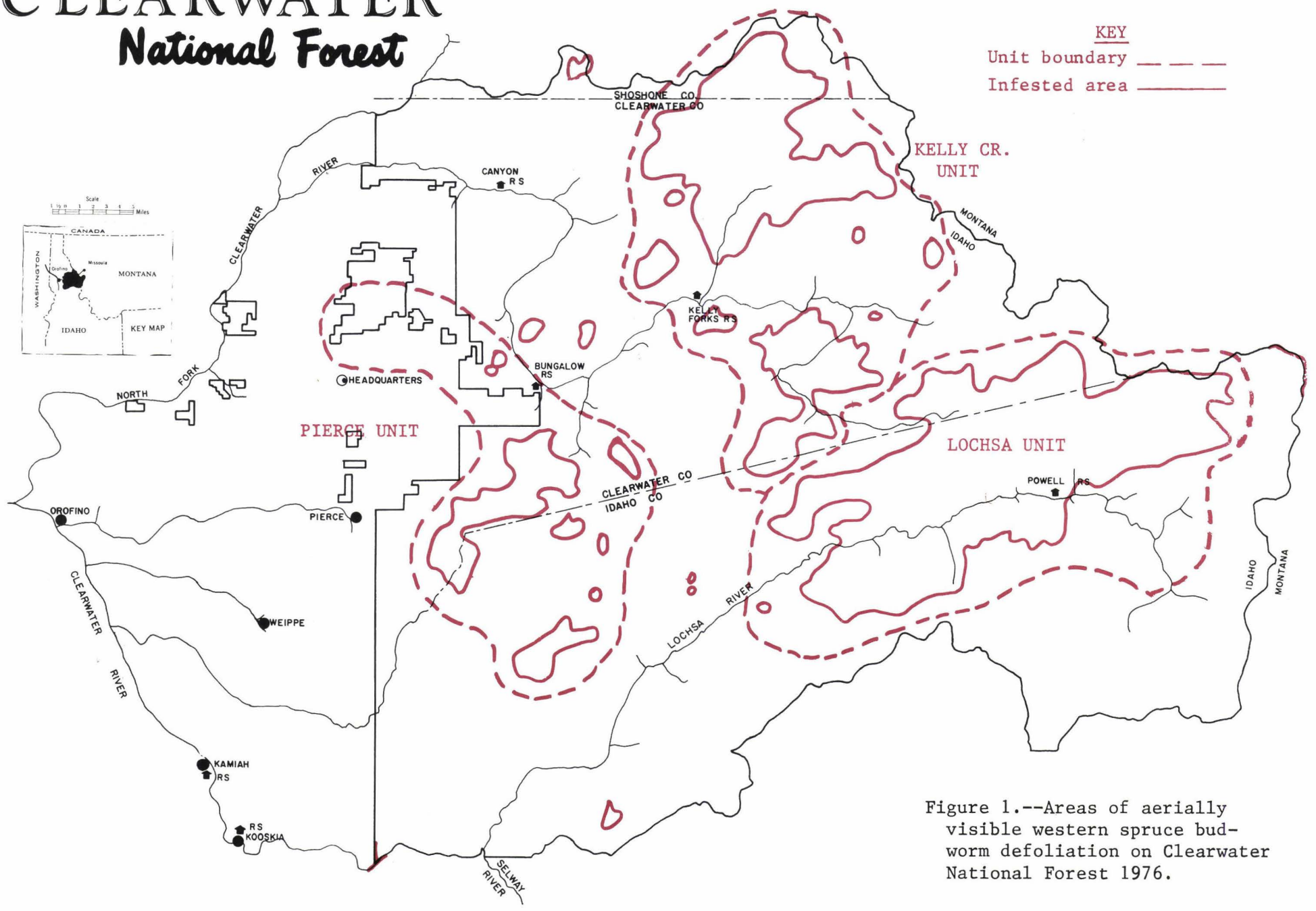


Figure 1.--Areas of aerially visible western spruce budworm defoliation on Clearwater National Forest 1976.

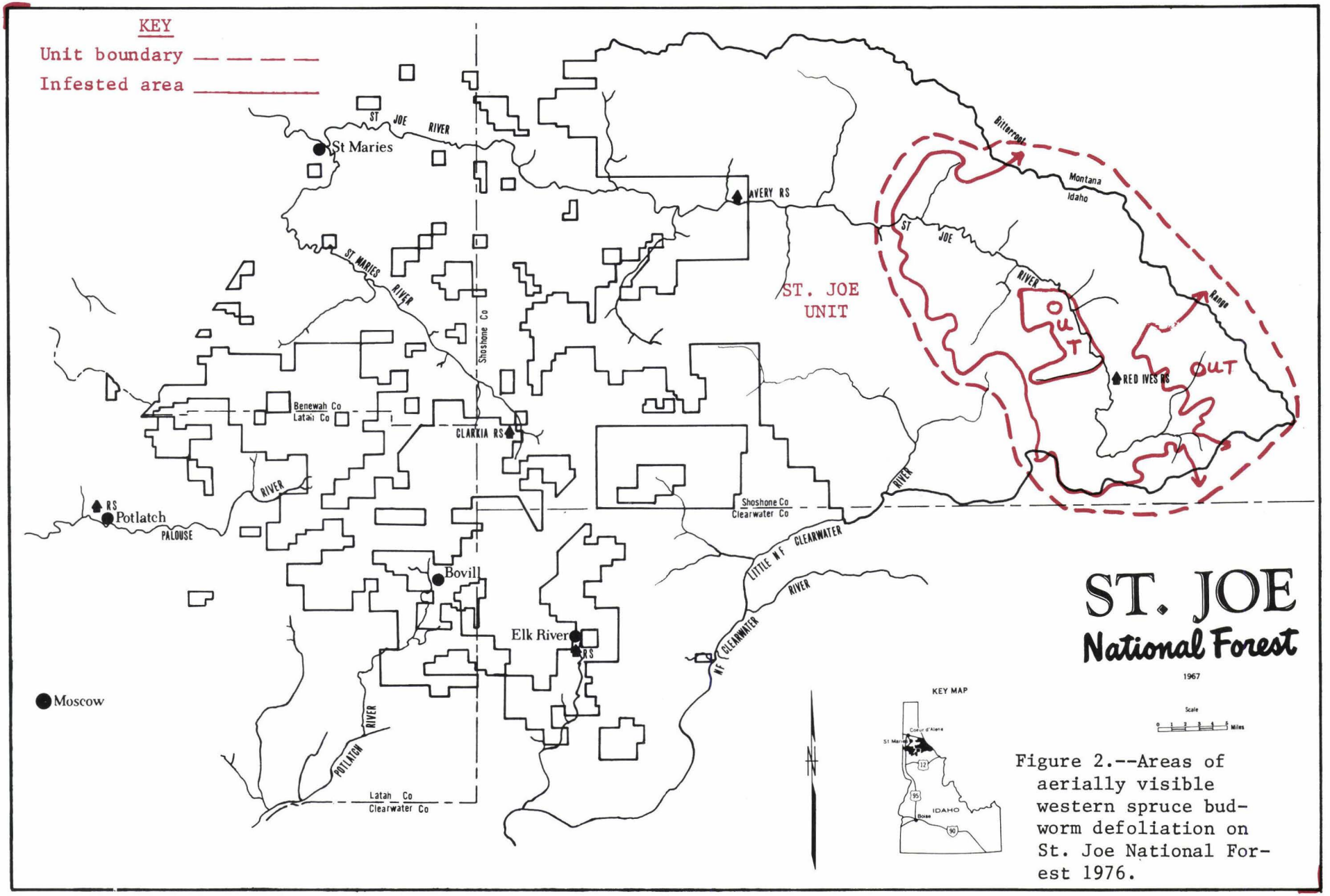


Figure 2.--Areas of aerially visible western spruce budworm defoliation on St. Joe National Forest 1976.

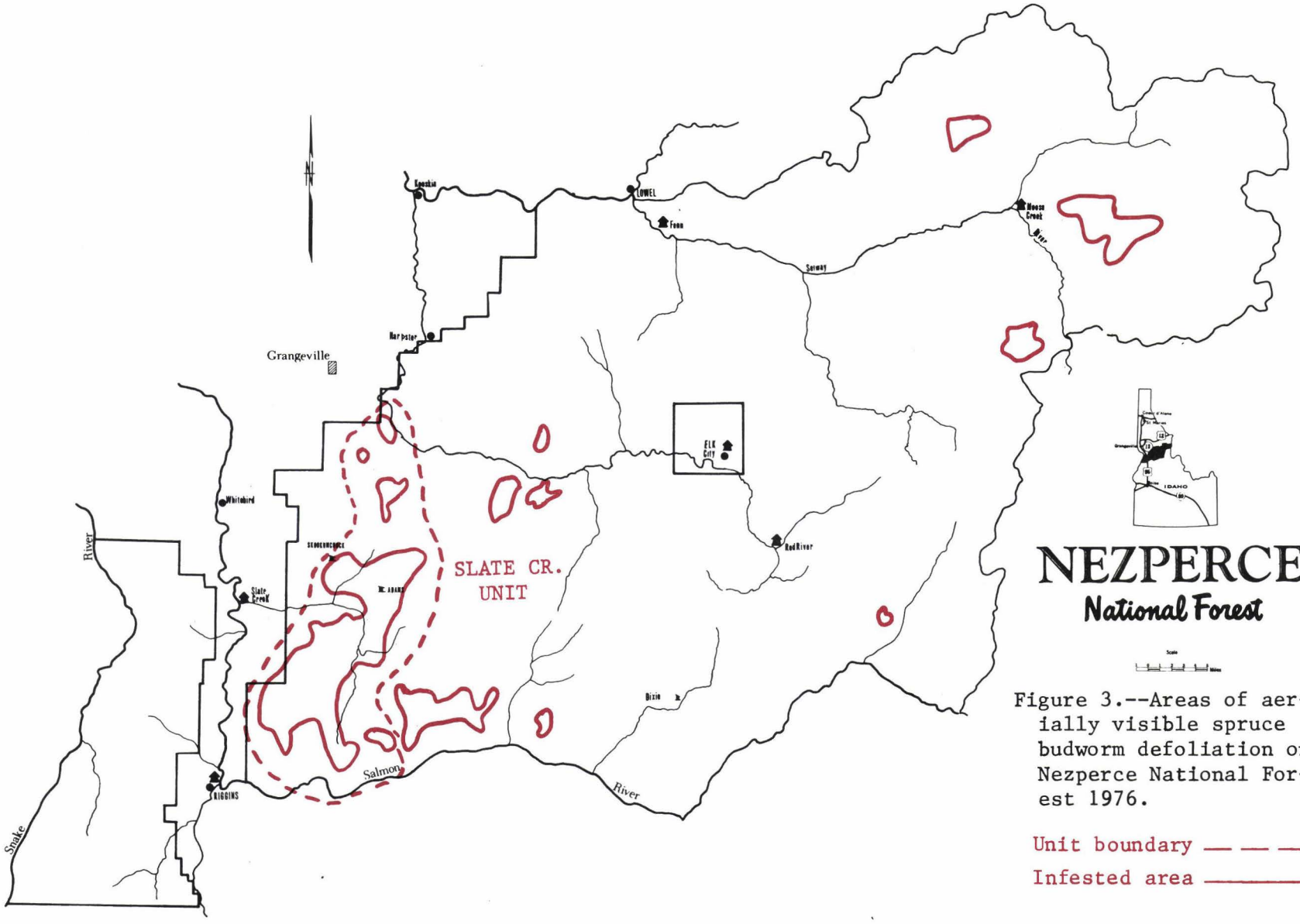


Figure 3.--Areas of aerially visible spruce budworm defoliation on Nezperce National Forest 1976.

Unit boundary — — — —

Infested area ————

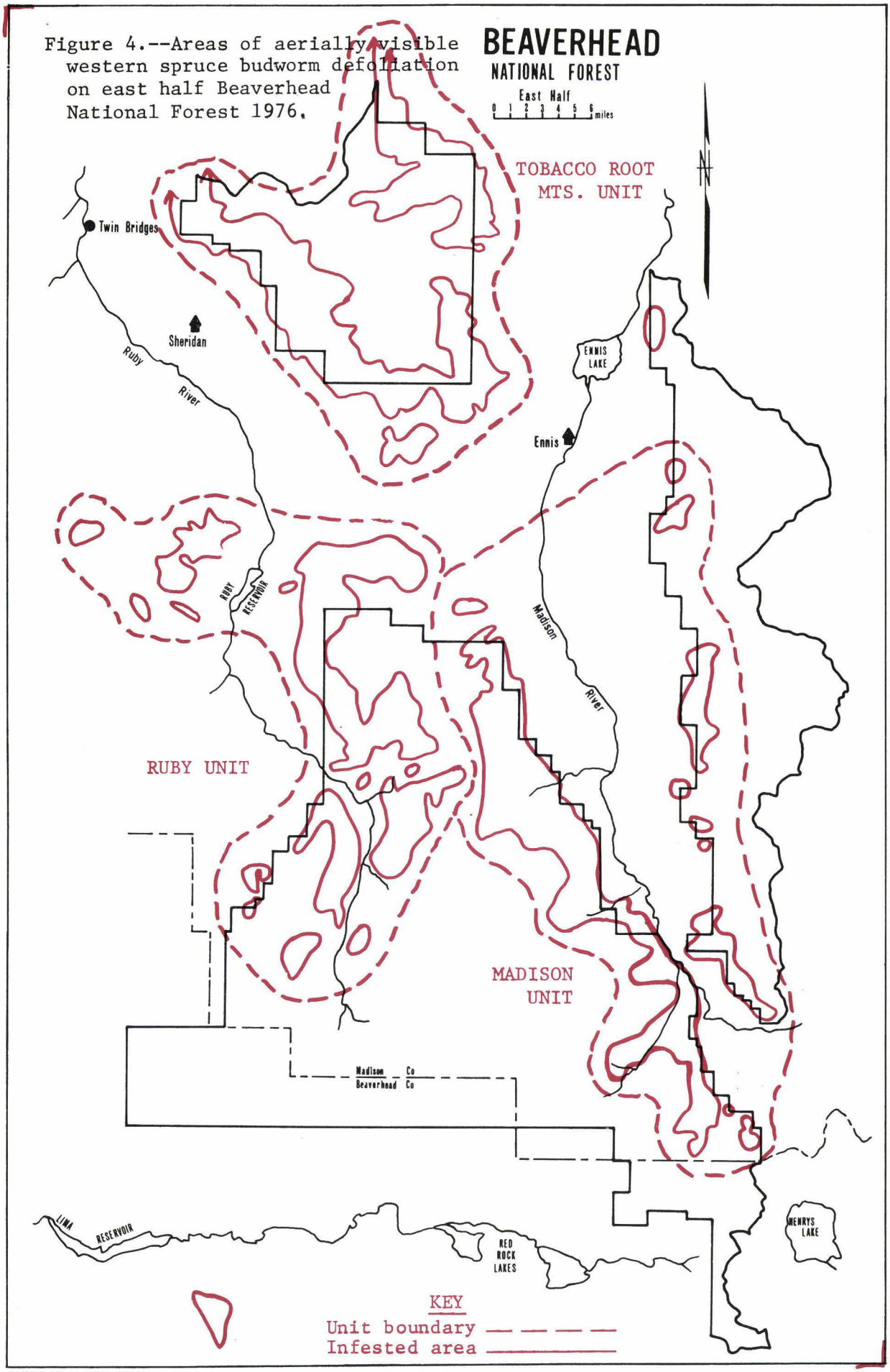


Figure 4.--Areas of aerially visible western spruce budworm defoliation on east half Beaverhead National Forest 1976.

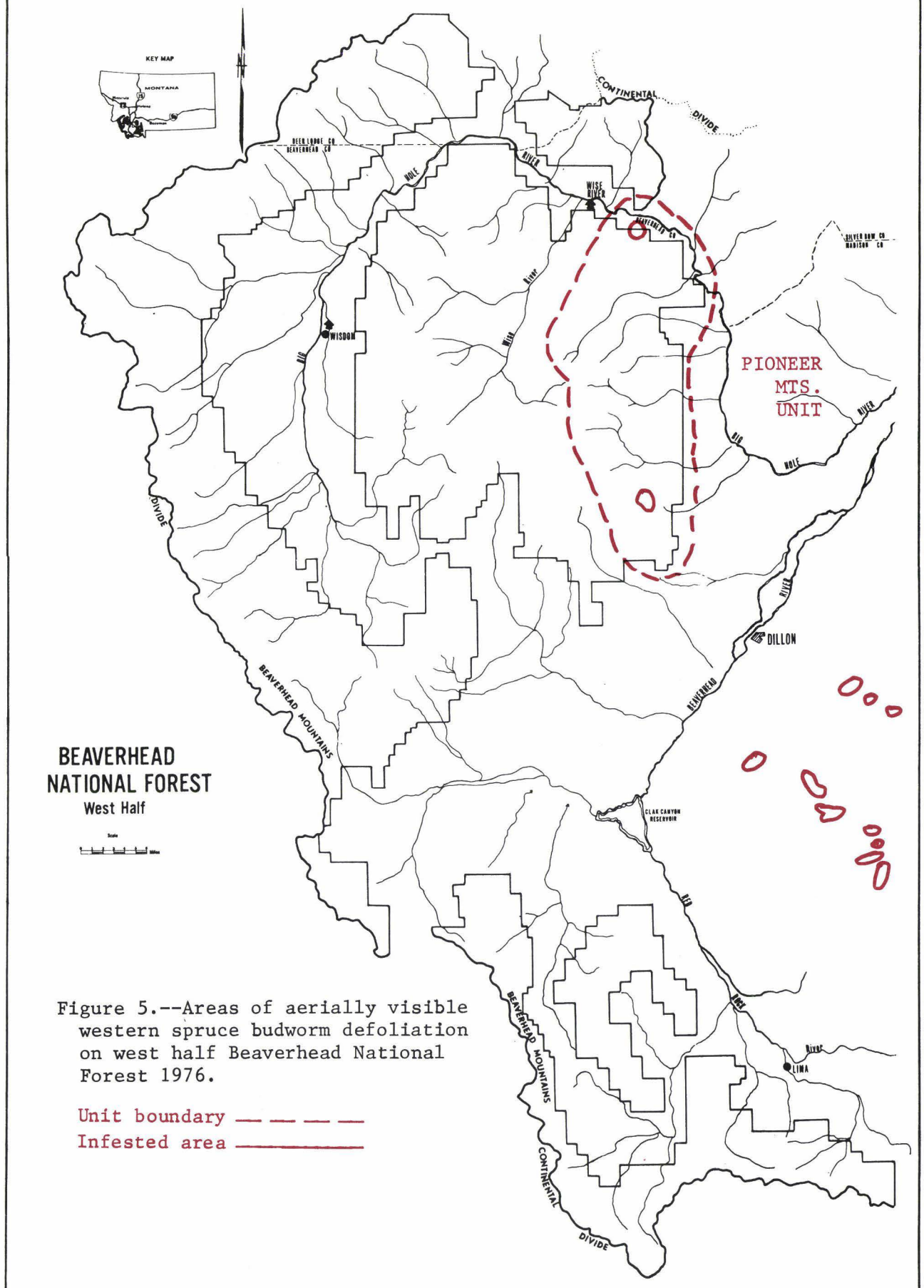


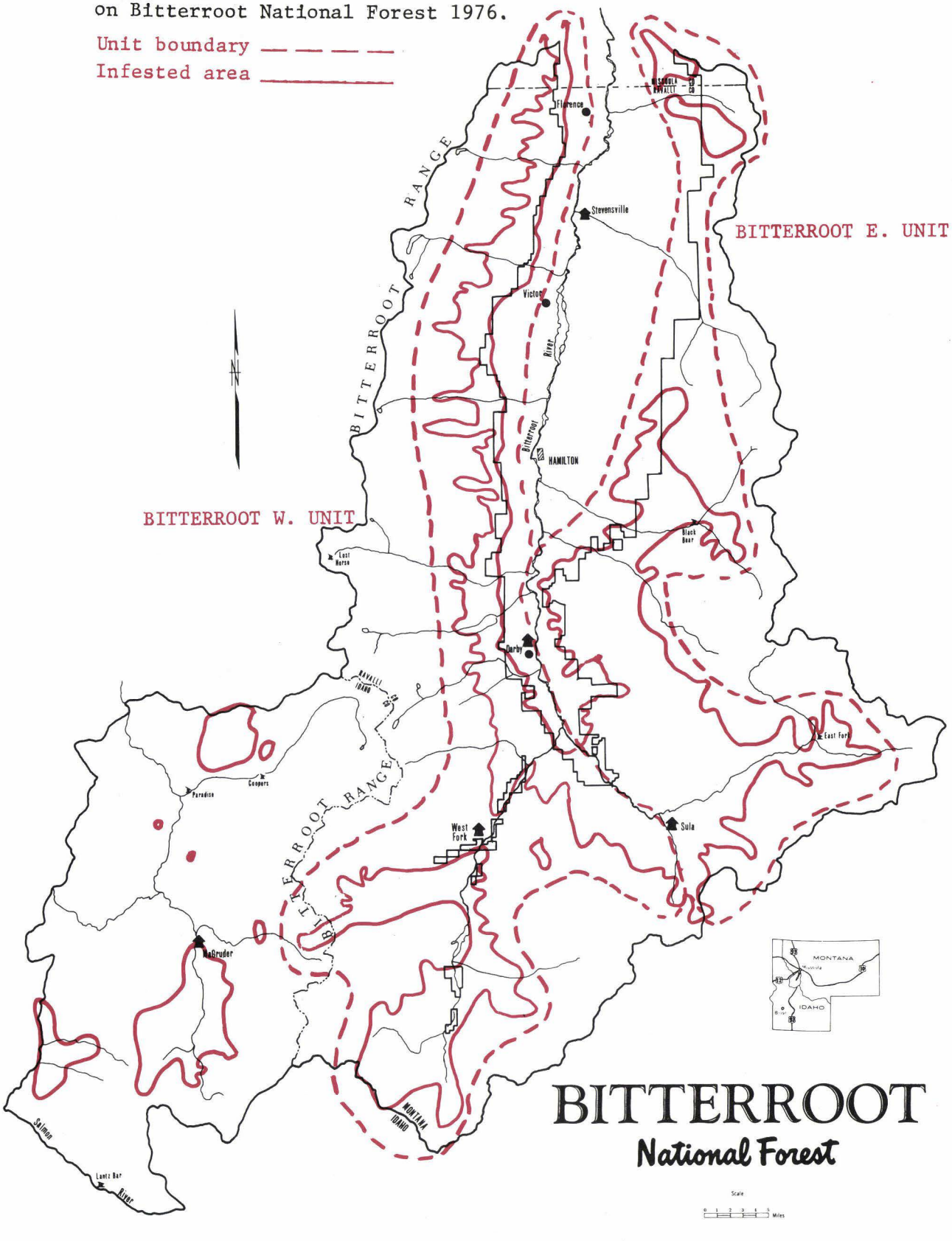
Figure 5.--Areas of aerially visible western spruce budworm defoliation on west half Beaverhead National Forest 1976.

Unit boundary — — — —
Infested area ————

Figure 6.--Areas of aerially visible western spruce budworm defoliation on Bitterroot National Forest 1976.

Unit boundary — — — —

Infested area _____



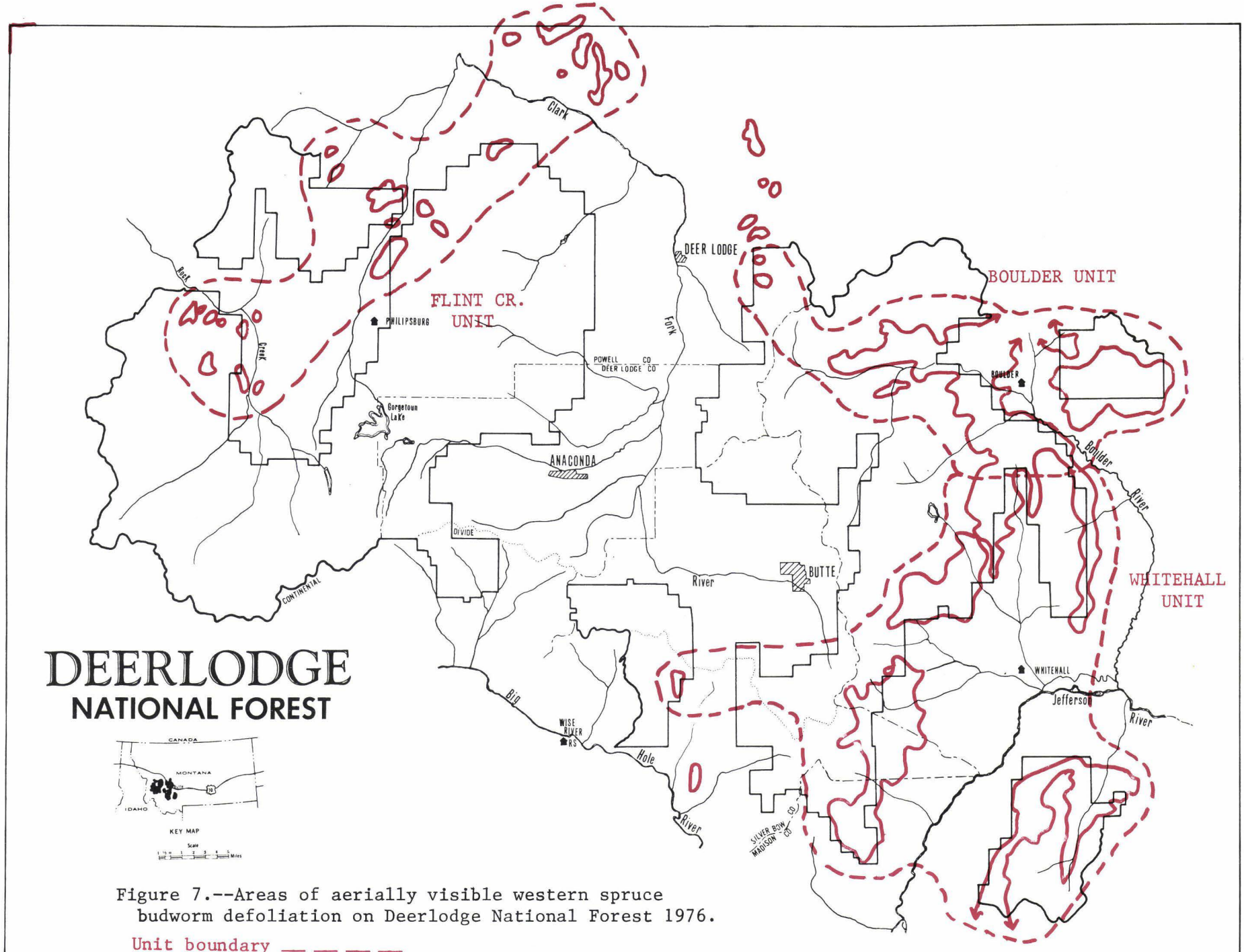


Figure 7.--Areas of aerially visible western spruce budworm defoliation on Deerlodge National Forest 1976.

Unit boundary — — — —

Infested area ————————

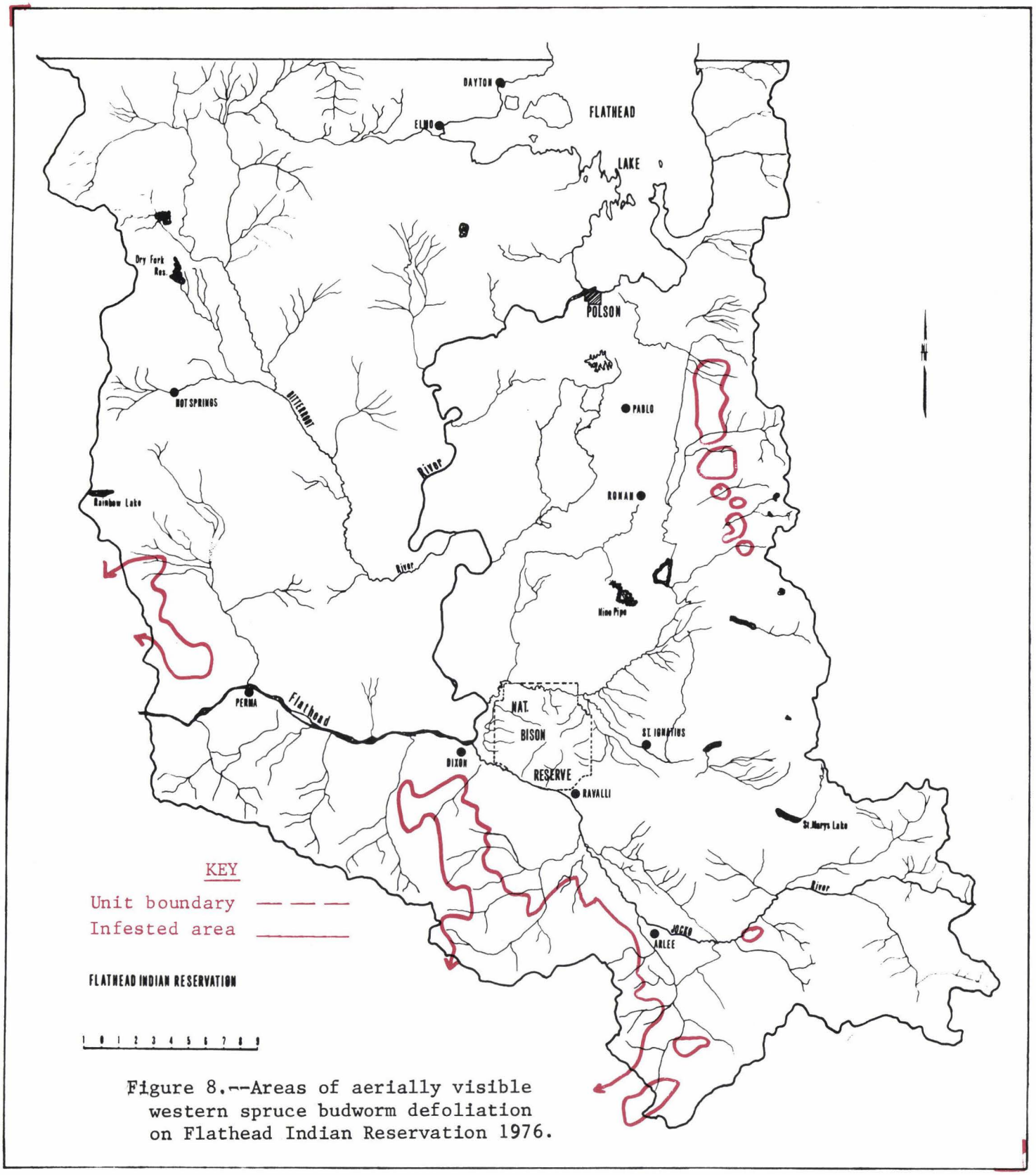


Figure 8.--Areas of aerially visible western spruce budworm defoliation on Flathead Indian Reservation 1976.

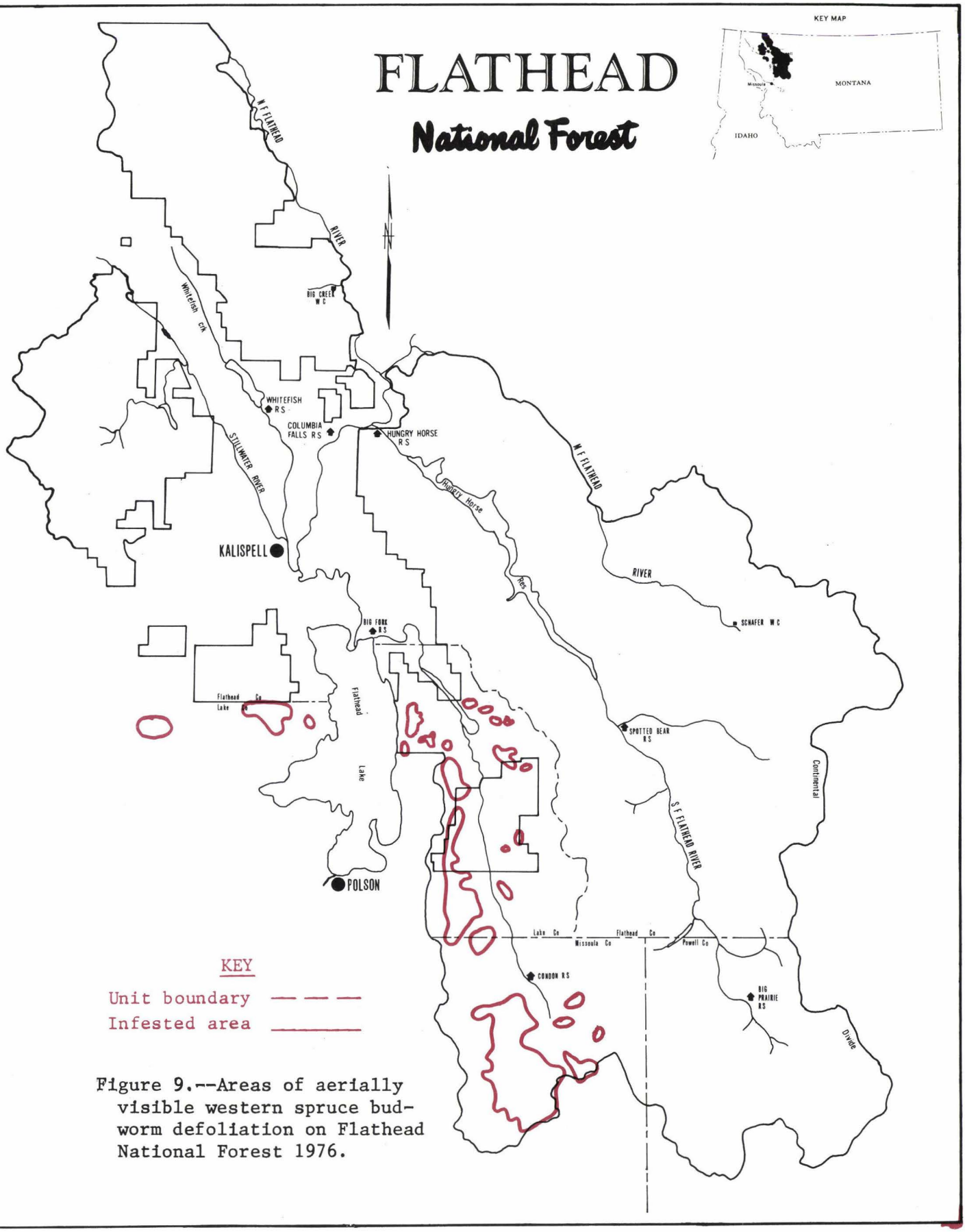


Figure 9.--Areas of aerially visible western spruce budworm defoliation on Flathead National Forest 1976.

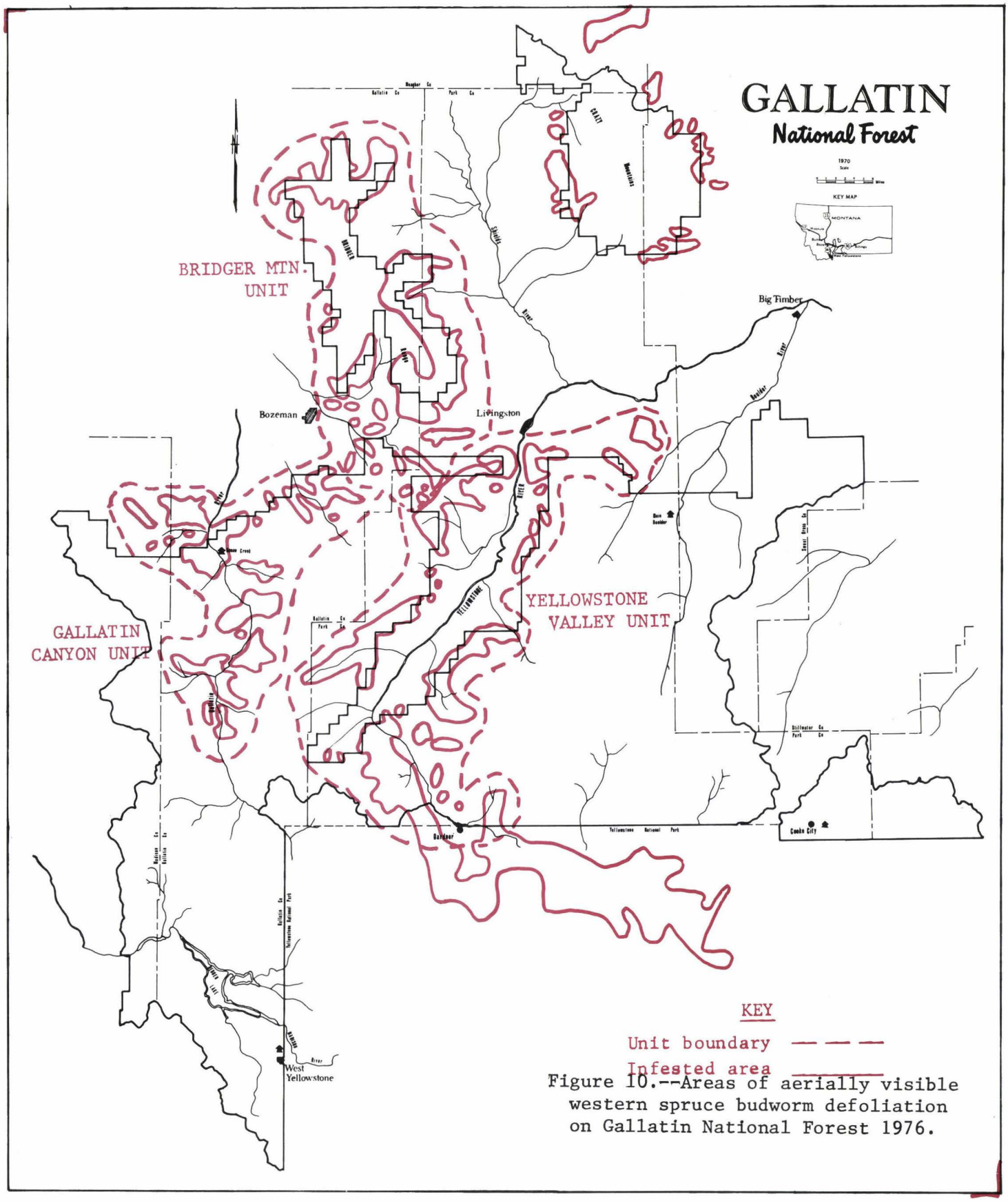


Figure 10.--Areas of aerially visible western spruce budworm defoliation on Gallatin National Forest 1976.

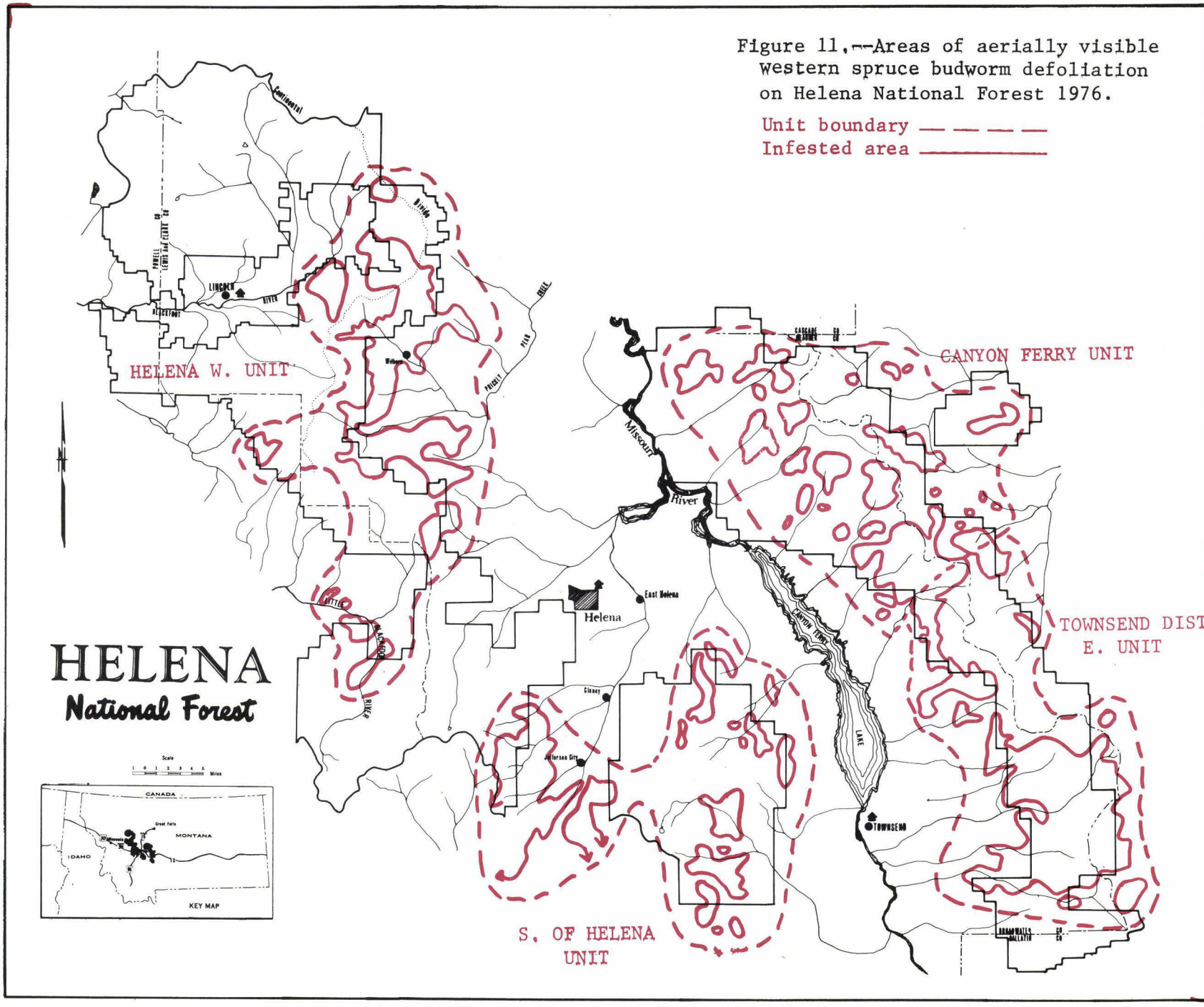


Figure 11.--Areas of aerially visible western spruce budworm defoliation on Helena National Forest 1976.
Unit boundary — — — —
Infested area ————
HELENA W. UNIT
CANYON FERRY UNIT
TOWNSEND DIST. E. UNIT
S. OF HELENA UNIT
HELENA
National Forest
Helena
East Helena
Clancy
Jefferson City
Townsend
Missouri River
CANADA
MONTANA
IDAHO
KEY MAP

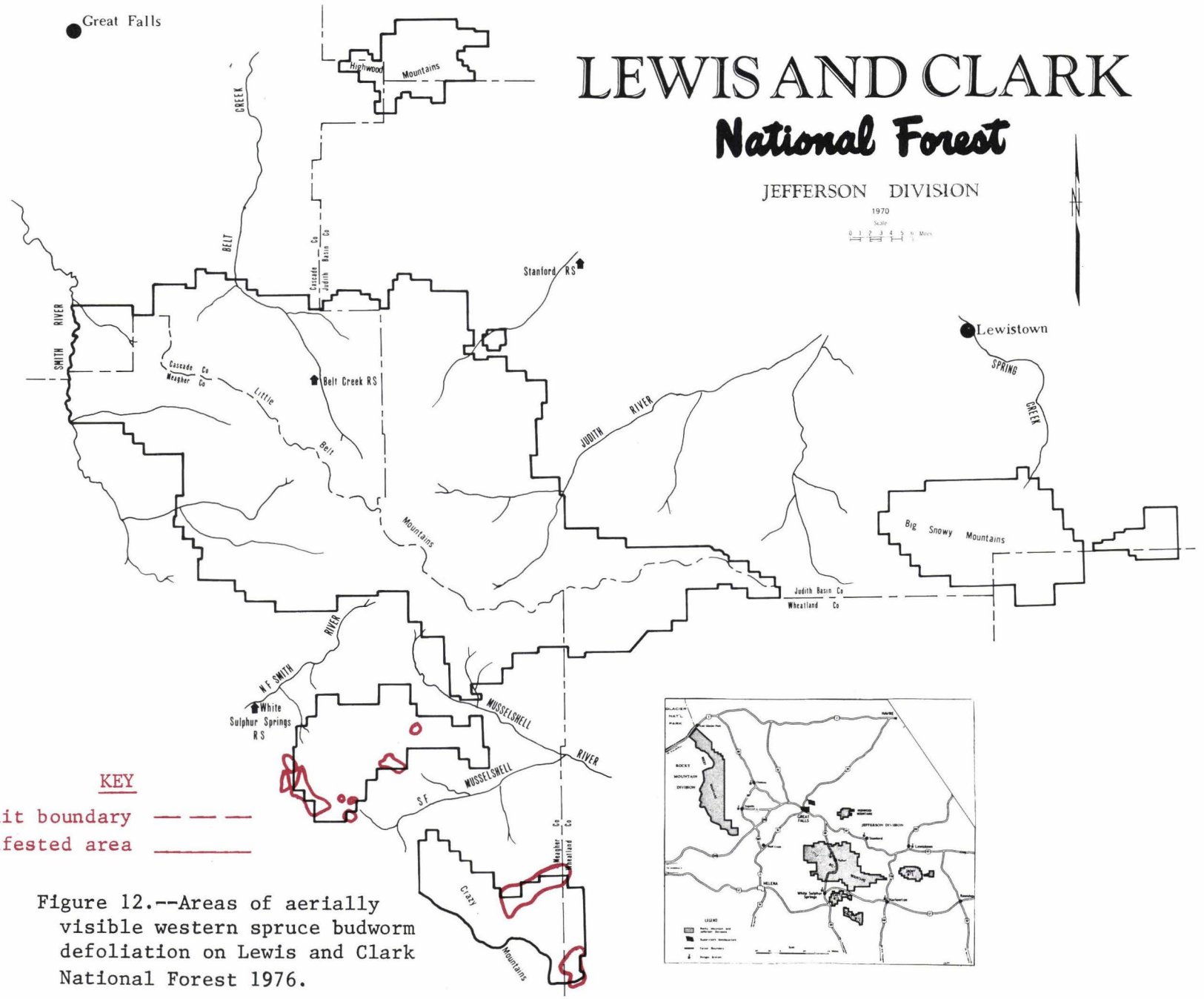


Figure 12.--Areas of aerially visible western spruce budworm defoliation on Lewis and Clark National Forest 1976.

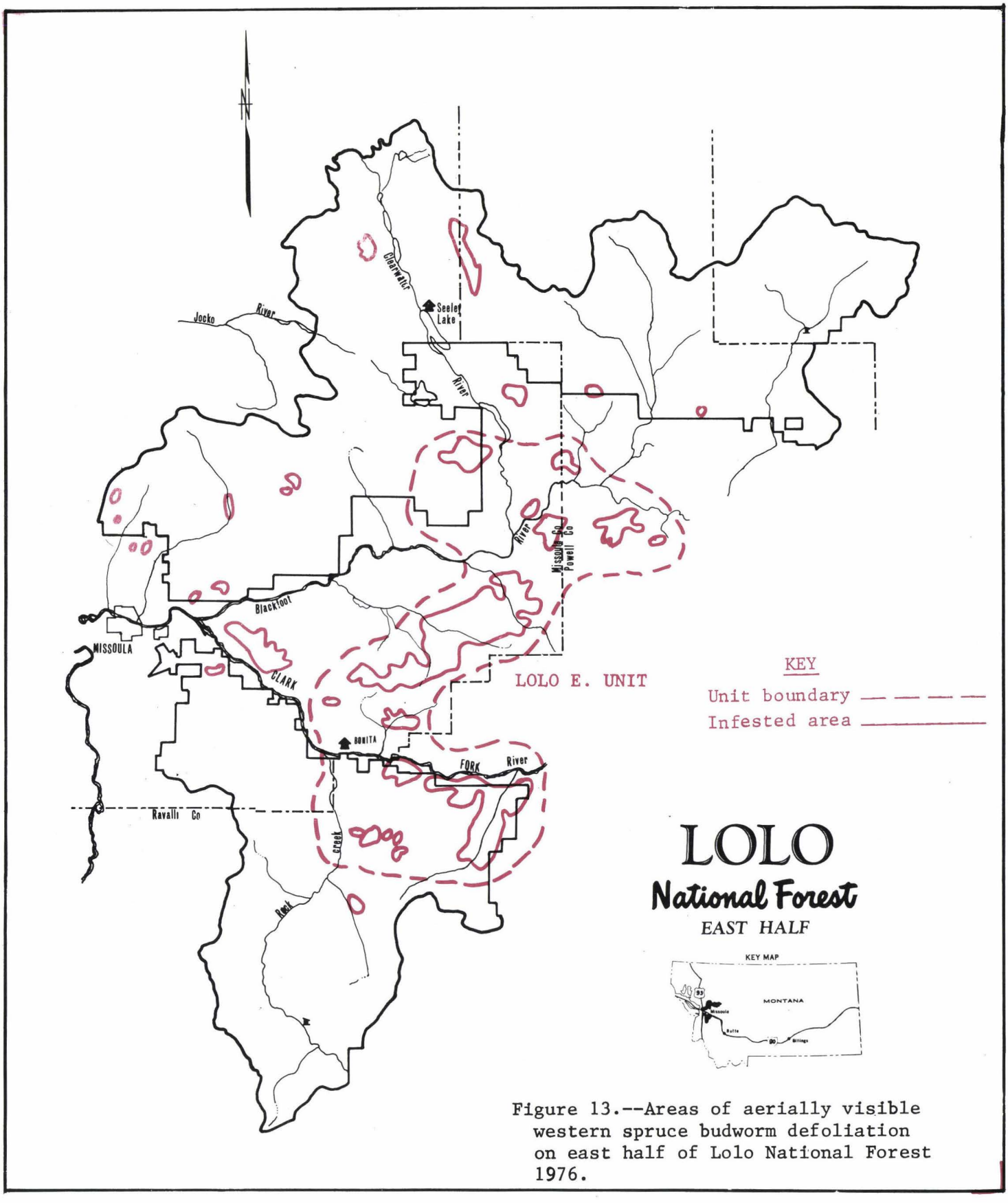


Figure 13.--Areas of aerially visible western spruce budworm defoliation on east half of Lolo National Forest 1976.

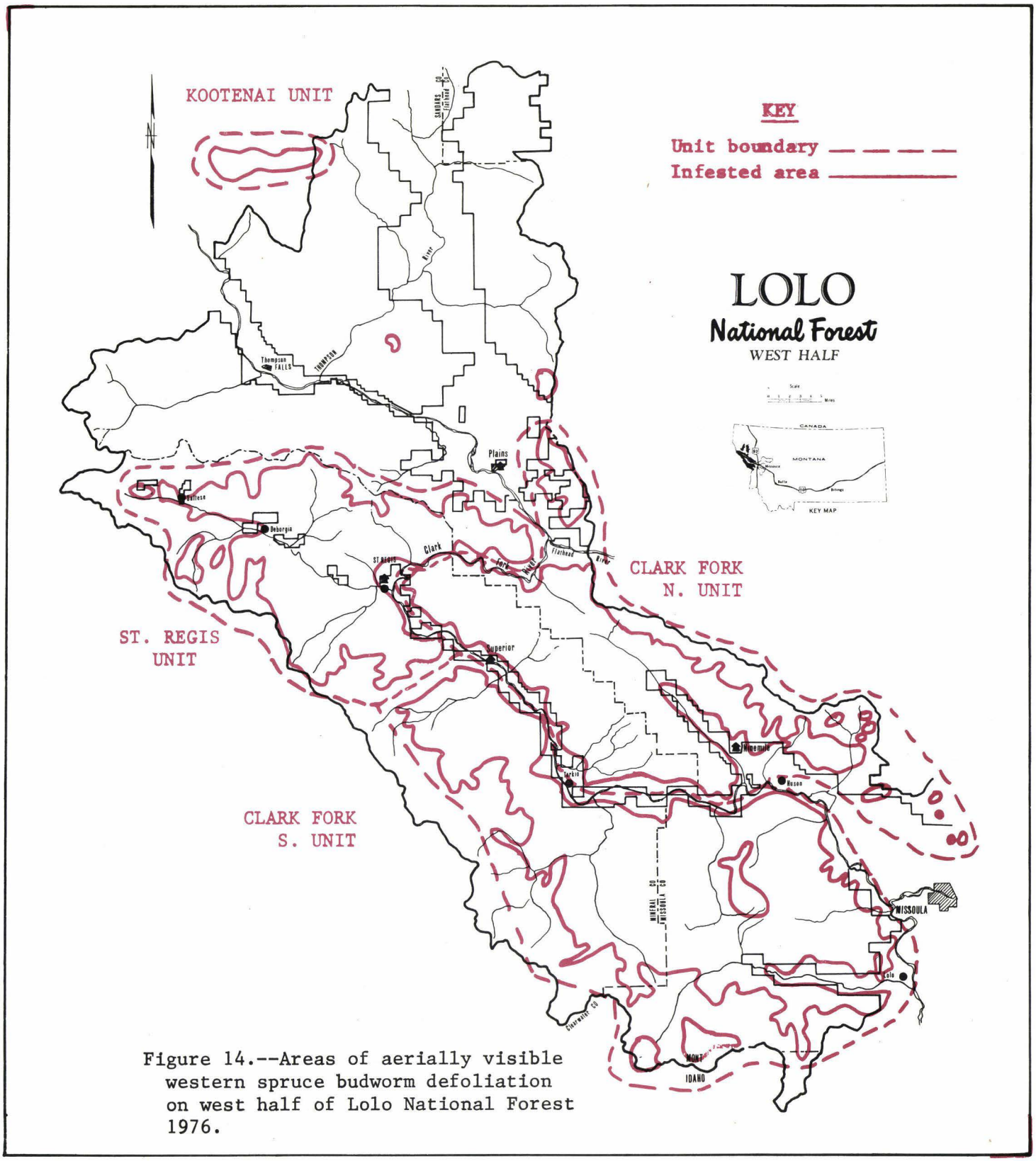


Figure 14.--Areas of aerially visible western spruce budworm defoliation on west half of Lolo National Forest 1976.

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